



Interagency Ecological Program

COOPERATIVE ECOLOGICAL
INVESTIGATIONS SINCE 1970

Environmental Monitoring Program Review 2001 Review Package

**Revised May 2001 according to results of the first review
meeting on May 8, 2001, in Tiburon, CA**

Contents:

PURPOSE AND CONTEXT OF THE 2001 REVIEW OF THE IEP ENVIRONMENTAL MONITORING PROGRAM	1
REVIEW PROCESS	4
REVIEW SCHEDULE WITH MEETING DATES (REVISED MAY 19, 2001)	6
COMMITMENT, EXPECTED PRODUCTS, AND COMMUNICATION	8
I. Review Participant commitment	8
II. Review participant products	9
III. EMP core staff commitment and products	9
IV. IEP SAG commitment and products	9
V. Communication	10
SUBJECT AREA REVIEW GUIDELINES	11
I. General guidelines	11
II. Format for written subject area review and proposed monitoring plan.	13
III. Standard questions	14
IV. Additional questions for specific subject areas	18
LIST OF BACKGROUND MATERIALS	20

For more information please contact

Anke Mueller-Solger (DWR-ESO, amueller@water.ca.gov, (916) 227-2194) or
Zachary Hymanson (DWR-ESO, zachary@water.ca.gov, (916) 227-7543)

Purpose and context of the 2001 review of the IEP Environmental Monitoring Program

The IEP Environmental Monitoring Program (EMP) is mandated by the State Water Resources Control Board (SWRCB) water right decision D-1641. This is the water right decision controlling exports and operations of the State Water Project and Central Valley Project. For the past 30 years, the monitoring program has routinely collected data on traditional water quality constituents, phytoplankton, zooplankton, and benthos in the Delta, Suisun Bay, and San Pablo Bay. The mandated objective of the IEP EMP is to monitor the effects of water project operation (i.e. flow and salinity regulation) on water quality and lower trophic levels and provide this information to project operators and to the SWRCB. As stated in D-1641 (p.149), this is

“To ensure compliance with the water quality objectives, to identify meaningful changes in any significant water quality parameters potentially related to operation of the SWP or the CVP, and to reveal trends in ecological changes potentially related to project operations [...].”

The current “water quality objectives for municipal and industrial beneficial uses” include explicit specifications for chloride, electrical conductivity, and flow (D-1641, pp. 181-191). In addition to these parameters, D-1641 also orders monitoring of many other chemical, physical, and biological parameters including dissolved oxygen, water temperature, secchi depth, turbidity, inorganic nutrients, chlorophyll *a*, and lower trophic level abundance (D-1641, pp. 192-193). Overall, the EMP has succeeded in fulfilling its mandated objectives during the past three decades. In addition, it has also made its data available to other data users.

Now beginning its fourth decade, the program is faced with many new challenges and opportunities such as its interaction with CALFED and the emergence of new technologies and information needs. This is an exciting time for Bay-Delta research and management. The 2001 review offers a unique chance to launch a reinvigorated, powerful environmental monitoring program for the 21st century. As described below, the 2001 IEP EMP review will examine all technical elements of the EMP. Review products will include a comprehensive review summary and a resulting redesigned monitoring plan.

The primary purpose of this review is to recommend a balanced, scientifically sound, implementable program design to ensure continued compliance with the water right permit conditions. An essential part of this review is to identify current and potential information needs and information users (“customers”) and explore if and how the EMP may be able to address these customer information needs. In addition to the SWRCB and water project operators complying with D-1641, users also include CALFED staff, scientists studying estuarine processes,

Box 1: Purpose of the Review

The purpose of this review is to recommend a balanced, scientifically sound, implementable environmental monitoring program design to fulfill water right permit conditions and address the needs of current and potential users identified during this review.

stakeholders, and the general public (Fig. 1). However, while the information needs of other programs and data users will be an important part of this review, reviewers should keep in mind that the primary responsibility of the EMP is to meet IEP's information needs and mandated permit requirements.

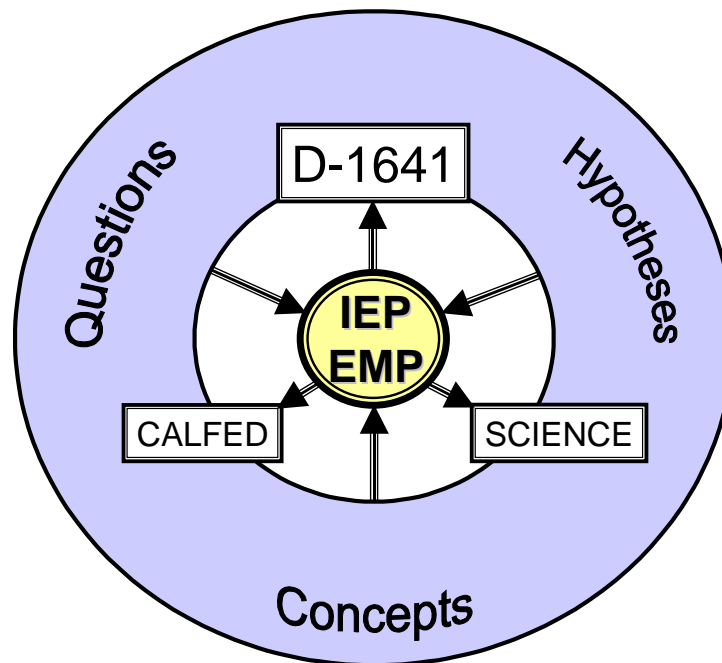


Fig. 1: The IEP EMP is at the center of coexisting and sometimes competing information needs (*i.e.*, D-1641, CALFED, Science) and fundamental program design elements (*i.e.*, concepts, questions, hypotheses) shaping the program and its elements. One objective of this review is to more clearly define the data users and their needs.

The approach to the 2001 EMP review is to define and address actual “customer”-specific information needs. This approach should also fulfill the broader, more general need for improved ecological understanding. Several recent review attempts have started by addressing this general need (*e.g.*, CALFED CMARP Report (1998, [s. http://calfed.ca.gov/programs/cmarp.html](http://calfed.ca.gov/programs/cmarp.html)) and IEP Technical Report 58 (1998)). While the 2001 EMP review will attempt to incorporate results from these efforts, it will focus on the identification and evaluation of customer-specific information needs as a tool to define areas most in need of revision. The intent is to increase the likelihood of successful implementation of recommendations as well as the usefulness and relevance of EMP information.

For each of the identified user information needs, the reviewers will evaluate all pertinent technical elements of the EMP (e.g., sampling sites and frequency, constituents, monitoring methods, analysis and reporting methods, etc.) and identify missing or neglected program elements and related future needs. Review participants should also address compatibility and opportunities for coordination and collaboration with other regional monitoring efforts (Fig. 2) and programs. With its current design, the EMP is one of the longest running and most productive estuarine monitoring programs in the country. In order not to disrupt the valuable long-term data set, changes to this program have to be very carefully considered. Additions to the program will be limited by the availability of funding and resources and will have to be clearly prioritized. The intent of the 2001 EMP review is to produce realistically implementable recommendations leading to increased “consumer satisfaction” while at the same time retaining the long-term integrity of the program. Identified needs and customers that cannot be served by the EMP will be summarized and publicized for potential integration into other programs. For example, geographic expansion of certain program elements may be identified as an urgent need. However, EMP resources may not be adequate to cover such an expansion, and/or adjacent existing monitoring or programs or other projects may be better suited to address this need.

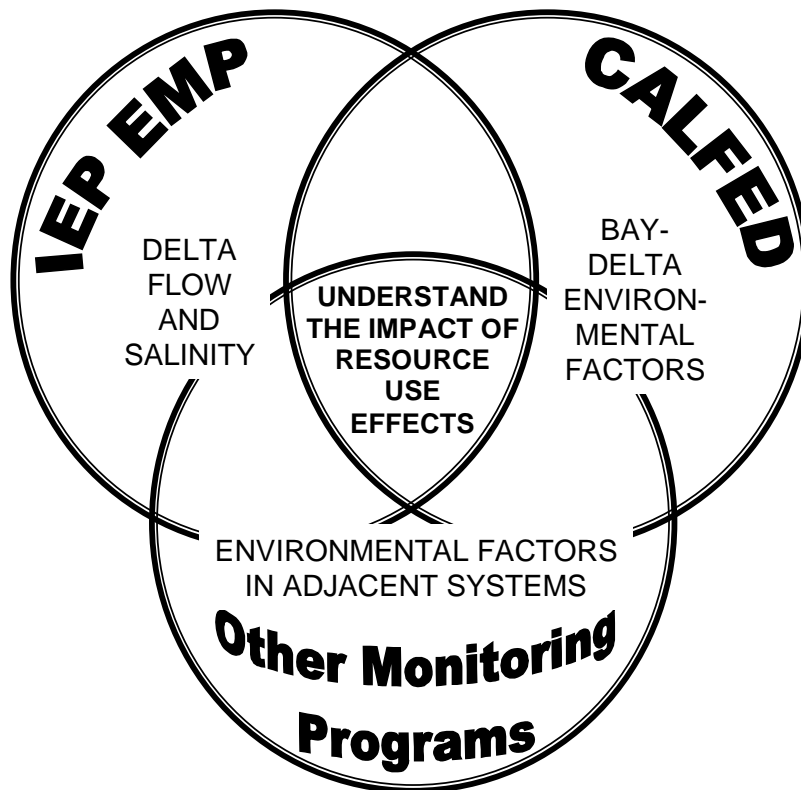


Fig. 2: The IEP EMP in relation to other monitoring efforts in the San Francisco Estuary.

Review Process

The 2001 IEP EMP review will be conducted following a multi-tiered approach involving several small subject area teams (SATs), a number of “big meetings”, the IEP Science Advisory Group (SAG), and core EMP staff (Fig. 3). A schedule for the review is given below.

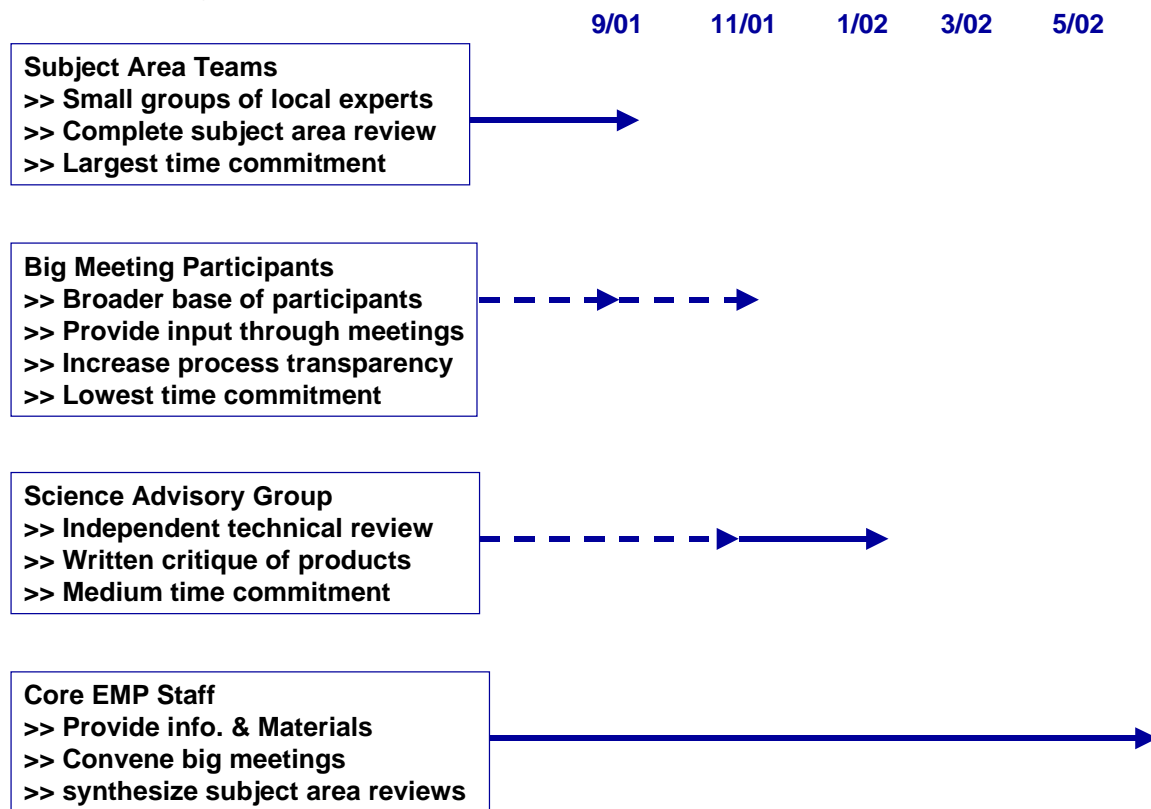


Fig. 3: Review participant groups and work periods. Dashed arrows: low time commitment. Solid arrows: higher time commitment.

The subject area teams (SATs) are the backbone of this review. These are small teams of invited local technical experts. The main task of these teams is to complete reviews of specific subject areas (Box 2). Although these teams may approach the reviews differently, the primary goal is to provide a written subject area review based on the format and questions provided below. Subject area reviewers must provide specific implementation strategies along with their recommendations. “What,” “why,” and “how” questions should receive equal emphasis in this review. Subject area team members will also participate in the big meetings. The results from the subject area teams will be integrated by selected team members (team leaders) and EMP staff into a comprehensive review summary and a draft monitoring plan. The time commitment envisioned for review participants working in subject area work teams and attending large

meetings is about 60 to 80 hours over six to eight months spent in meetings, communicating with fellow subject area team members, and reviewing materials.

Box 2: Subject Areas

- 1. Water Quality (physical & chemical constituents)**
- 2. Phytoplankton**
- 3. Zooplankton**
- 4. Benthos**

The SAT products and the recommended draft monitoring plan will be reviewed by the IEP Science Advisory Group (SAG). This group of scientists will provide independent technical peer review and provide a written critique of the review products, which will be used in conjunction with other materials to craft a balanced, scientifically sound monitoring program. SAG members are also invited to provide feedback at any time during the review and participate in the big meetings.

The big meetings provide a forum for information exchange and comments from a broader audience of stakeholders and agency staff. These participants provide a broader base of review, but not necessarily at the same level of detail as the subject area teams or the SAG. Big meeting participants are expected to read the materials provided to them, and provide input at these meetings. Big meeting participation is very important to this process as it is the main way of receiving broader input and making this review as transparent as possible.

Core EMP staff from DWR, USBR, and USGS will work across all levels. These staff will be responsible for providing all of the information and background materials used in this review. The staff will convene the big meetings with the help of a facilitator. The core staff will also be responsible for synthesizing review products. Finally, through meetings and written correspondence, the core staff is responsible for providing progress reports during the review and subsequent program implementation. Before implementation, the core staff will ensure the revised program is reviewed and approved by DWR and USBR management. Unless something changes through CALFED, these agencies will remain responsible for the funding and implementation of this program. The proposed program will then be presented to the SWRCB Executive Director, who must evaluate and approve any changes to the monitoring program. Changes to the proposed program are possible during both agency evaluation periods. The EMP core staff is responsible for moving the proposed program through these steps toward eventual implementation.

More information on the review process and on the IEP EMP can be found at <http://iep.water.ca.gov/emp>. Numerous analyses of the available data have been conducted over the years. Several selected reports are available to subject area work team and SAG members. Other publications describing these analyses are listed in the extensive bibliography available at <http://iep.water.ca.gov/emp>. No new analyses are expected for this review.

Review Schedule (revised May 19, 2001)

This schedule identifies actions (underlined), person(s) responsible to accomplish the actions (in parentheses), and dates by which these actions need to be accomplished (in brackets). This schedule was prepared by the IEP Water Quality Project Work Team. Completed preparatory steps are not included in this schedule. **Bold: Important meetings and dates.**

1. Orientation meeting. Convene a meeting of all review participants, explain their roles and responsibilities. (Mueller-Solger and Hymanson) [May 8, 2001.] = First BIG MEETING
2. Technical Small-Group (SAT) Breakouts.
 - A. Conduct Subject Area Team (SAT) breakout meetings. Discuss relevant concepts with SAG members, then develop monitoring plans for subject areas. Group leaders submit plans to Mueller-Solger. (SAT members) [May-June 2001.] = Several SMALL MEETINGS
 - B. Compile/collate subject area plans. (Mueller-Solger.) [July 2001.]
3. Integration meeting. Re-convene all review participants for discussion of subject area team products. (Mueller-Solger and Hymanson) [**July 30 or 31, 2001**] = **Second BIG MEETING**
4. Draft Plan. Convene **subject area team leader workshop** to formulate comprehensive draft monitoring plan. Team leaders and EMP core staff integrate SAT and integration meeting results and prioritize recommendations (Mueller-Solger and Hymanson) [**August 21-22, 2001**]
5. SAT review of draft plan. Subject area team members review draft plan and provide comments to EMP core staff. (Subject area team members) [September 31, 2001.]
6. Revision meeting. Prepare second (revised) draft plan based on comments received from SAT members. Convene meeting of all review participants to discuss revised draft plan. (Mueller-Solger) [**November 14, 2001**] = **Third BIG MEETING**
7. SAG Review. IEP SAG members receive all review products submitted by EMP staff and subject area teams. (IEP SAG members) [December 6, 2001]
8. **SAG and SAT leader meeting.** Convene meeting of SAG members, SAT leaders and EMP core staff to discuss SAG review. (Mueller-Solger and Hymanson) [**January 8, 9, or 10, 2002**]

9. Revise Draft Plan. Prepare third draft plan based on comments received from SAG review and discussed during January meeting. (Mueller-Solger) [February 2002]
10. IEP Review of Draft Plan. Distribute draft plan for internal IEP review. Secure IEP management approval of draft plan pending revision to address comments. (IEP agencies) [April 2002.]
11. Develop Final Plan. Revise plan based on comments received from IEP review. Submit plan to DWR and USBR management for review and approval for formal transmittal to SWRCB. (Mueller-Solger, Hymanson, and Lentz) [May 2002]
12. Final Plan Submittal. Submit final Compliance Monitoring Plan proposal to SWRCB Executive Director for approval. (DWR and USBR) [June 2002] – No hearings necessary, see condition 11E of Water Right's Decision 1641

Commitment, expected products, and communication

I. Review Participant commitment

A. Big meeting participant commitment

1. Big meeting participants will commit to participating in all or several of the following meetings:
 - Orientation meeting – May 8, 2001, Tiburon
 - Meeting to discuss subject area team products – July 30 or 31, 2001
 - Revision meeting to discuss draft monitoring plan – November 6, 2001
2. Big meeting participants will read material provided by EMP staff at <http://iep.water.ca.gov/emp> to facilitate constructive discussions.

B. Subject area team member commitment

- Subject area team members will participate in all or several big meetings and read background materials specified in I., above. At a minimum, subject area team members should attend the first big meeting (orientation, May 8, 2001).
- The main task of the subject area teams is to complete a subject area review. To this end, team members will meet and communicate with each other as necessary to complete this review. While subject area teams may approach the subject area reviews differently, their main common goal is to provide a written subject area following the format and questions provided.

C. Subject area team leader commitment

Each subject area team has a team leader responsible for:

- Coordinating the subject area teams' activities
- Record keeping
- Assembling the subject area review
- Acting as liaison between subject area work teams, EMP staff, and the SAG.
- Participating in a SAT leader and EMP core staff workshop to synthesize SAT results - August 21&22 , 2001
- Participating in SAG, SAT leader , and EMP core staff meeting to discuss SAG review - January 8, 9, or 10, 2002

II. Review participant products

- A. Review participants solely attending the big meetings are not responsible for any written products, although written feedback is welcome. Big meeting participants will contribute through constructive discussion participation.
- B. Review participants working in subject area teams will be responsible for the following products assembled by their team leaders:
 - A written monitoring plan for their subject area based on a review of the subject area addressing all standard and subject area questions prepared by IEP EMP staff as well as additional issues deemed relevant by the team members. Review notes should be attached to the monitoring plan.
 - Written feedback for the comprehensive review summary and draft monitoring plan drafted during the August SAT leader and EMP core staff workshop and assembled by EMP core staff.

III. EMP core staff commitment and products

EMP core staff will be responsible for providing background materials, convening and, with the help of a facilitator, moderating the large meetings, assembling subject area reviews, and, together with the SAT leaders, preparing a draft monitoring plan. Further, EMP staff will be responsible for submitting the draft monitoring plan to DWR and USBR management and subsequently to the SWRCB, and for the timely implementation of recommended and approved changes. They will give regular progress reports to the IEP coordinators and to the SAG. They will participate in all meetings and maintain a review web site.

IV. IEP SAG commitment and products

SAG members will initiate and set the tone for the work of the subject area teams by participating in the orientation (=“first big”) meeting. Later in the review process, SAG members will evaluate the resulting subject area reviews and monitoring plans as well as the comprehensive documents synthesized by SAT leaders and EMP core staff. They will submit a written critique and recommendations for program revisions to the EMP review coordination team (Hymanson, Lentz, Burau, Mueller-Solger) and the IEP Program Manager, Chuck Armor. After completion of the review, SAG members will be updated by EMP staff about progress in implementation during the annual IEP meeting in Asilomar and upon request. If implementation of some recommendations proves too difficult, SAG members might advise EMP staff about how to modify these recommendations.

V. Communication

- A. EMP website: Relevant material for the review will be made available to review participants at <http://www.iep.water.ca.gov/emp>.
- B. E-mail reflectors: Special e-mail reflectors have been created for all review participant groups. Addressing e-mails to the following e-mail reflectors will automatically send e-mails to all participants in the respective group(s). A list of participants will be sent to review participants and updated as needed.
1. Water Quality SAT: wq@water.ca.gov
 2. Phytoplankton SAT: phyto@water.ca.gov
 3. Zooplankton SAT: zoo@water.ca.gov
 4. Benthos SAT: benthos@water.ca.gov
 5. Subject area team leaders: leaders@water.ca.gov
 6. IEP SAG (review participants only): sag@water.ca.gov
 7. Big meeting participants: large@water.ca.gov
- C. EMP core staff contact:

Anke Mueller-Solger
Department of Water Resources
Environmental Services Office
3251 S Street, Room C-25
Sacramento, CA 95816-7017
Office: (916) 227-2194
Fax: (916) 227-7554
amueller@water.ca.gov

Subject area review guidelines

The following section provides guidelines for evaluating the IEP EMP sampling program for each specific subject area (SA). Adherence to these guidelines will facilitate the eventual synthesis of the subject area reviews into a cohesive and comprehensive environmental monitoring plan. The guidelines have been substantially revised in response to comments received during the May 8, 2001, orientation meeting.

The 2001 EMP review will focus on the identification and evaluation of customer-specific information needs and on how to meet these needs. The intent is to conduct a pragmatic review aimed at achieving a high degree of actual implementation of review recommendations. Though no longer the primary tool used in this review, a conceptual model of subject area specific ecological processes and functions is helpful. SAT members are encouraged to provide a conceptual model for their subject area in addition to the “customer oriented” evaluations.

I. General guidelines

- Each subject area team should **identify information needs and customers** for information in your subject area. Produce a **table** (see attached blank table) with the following column headings, using one row for each identified information need:
 1. Present information needs
 2. Currently monitored constituents
 3. Current method and data compatibility with other programs
 4. Current customers
 5. Current customer satisfaction (Are needs met? Efficiently?)
 6. Recommendations for maintaining or improving customer satisfaction
 7. Related future information needs and potential customers

Use this table as your primary tool for evaluating your EMP subject area. Overlap or collaboration opportunities with other subject areas or monitoring programs should be noted.

- Geographic boundaries: information needs for the entire estuary (Delta and Bays) may be considered and reported in the subject area reviews. However, alternatives to EMP monitoring outside its core area (Delta, Suisun, and San Pablo Bays) should be explored (e.g., collaboration or coordination with other programs, new CALFED projects, etc.) to not overly tax the limited EMP resources.

- In your subject area work team, investigate the general state of knowledge in your subject area considering both anthropogenic and natural pressures on SA constituents. In many cases, this has recently been done by the CALFED CMARP effort, see <http://calfed.ca.gov/programs/cmarp/contents.html>. The conceptual model(s) adopted from CMARP or elsewhere (e.g. IEP report 42) or newly created will serve as a backdrop for the subsequent justification of your proposed subject area monitoring plan. If possible, articulate the underlying conceptual model through a simple diagram or explanatory text.
- Further evaluate the current EMP based on your “Information need table” and conceptual model. You may use the standard and SA specific questions listed below for your evaluation. Note, however, that **adherence to these questions is no longer required**, although it is encouraged to facilitate later synthesis. Substitute “SA” in the standard questions with your specific subject area (e.g. benthos, zooplankton, etc.). Subject-area specific questions are listed below the standard questions. Optionally, these questions could also be considered by the other subject area teams. SA teams 2, 3, and 4: see also specific questions for your combined SAs below individual SA specific questions. In addition, please feel free to address any additional relevant questions and issues not raised here.
- Use your information need table, conceptual model, answers to the provided questions, or anything else you may think of as a basis for devising and justifying a proposal for a subject area monitoring plan according to the **format given in II**.
- Prioritize your recommendations. In addition to EMP monitoring, consider recommending pilot or special studies as well as addressing identified needs through other, possibly more appropriate programs.
- Include specific implementation strategies for the recommended program revisions. Also include recommendations for improving data analysis, synthesis, storage and reporting and quality assurance and control. An important objective of this review is to improve the “data to information” aspects of the program.
- Include relevant references to journal articles, reports, etc. with your recommendations as appropriate.
- Selected team members (leaders) and core IEP EMP staff will integrate the subject areas reviews. IEP EMP staff will then prepare a comprehensive summary and draft monitoring plan proposal for participant review and comment.

II. Format for written subject area review and proposed monitoring plan.

Note: The synthesized, comprehensive review and proposed monitoring plan will also follow this format. Adherence to this format will greatly facilitate later synthesis.

A) Abstract

B) Subject Area Review

1. Brief introduction – conceptual model and subject area history, approach to SA review
2. “Customer oriented” program evaluation (with summary table, see General Guidelines):
 - a) Identification of information needs and customers
 - b) Current customer satisfaction and compatibility with other programs
 - c) Related future needs and customers
3. Prioritized recommendations with justifications and implementation strategies.
4. Opportunities for coordination with other programs and addressing complex issues such as contaminants monitoring
5. Conclusions

C) Proposed Subject Area Monitoring Plan

1. Brief description of program design and rationale
2. Tables and/or figures: sampling parameters, stations, methods (referenced) with QA/QC procedures, and estimates of resources needed (including transportation, if possible with costs) and staff effort (e.g., lab, boat, data analysis etc. days)
3. Plan for converting data into useful information. Include procedures and reporting format.
4. Provisions for special studies and coordination with other programs

D) References

E) Attachments

Standard questions

Please note: Written answers to these questions are no longer required!

Instead, please follow the format given in II. Use the questions as suggestions for considerations for the evaluation of your subject area.

A. Sampling design.

1. Constituents.

Are appropriate measurements being made in your SA (constituents, time and space)? Consider measurements that directly relate to your SA as well as those measurements that provide important contextual background information needed to understand the measurements in your subject area. For example, understanding temporal fluctuations in chlorophyll-a may require knowledge of solar radiation, water temperature, turbidity, etc. If the appropriate measurements are not being made, what additional measurements should be made? And why?

- a) Score the measurements in your SA according to their current and potential utilization by data users (water project operators, CALFED, the scientific community):

1=regularly used,
2=potentially useful,
3=of questionable usefulness,
4=useless

- b) Score the measurements according to the appropriateness and quality of sample collection, processing and analysis procedures:

1=state-of-the-art,
2=reasonable,
3=questionable,
4=objectionable

- c) For scores greater than one in a) or b) above: what are your recommendations for change? How would you implement these changes?
- d) Should new techniques for sampling and analysis be incorporated into the EMP (e.g. remote sensing, measurement of various biomarkers, etc.)?
- e) Should monitoring-related special studies be conducted (e.g. to test new sampling and analytical techniques, evaluate sampling sites,

etc.)? Which studies? What question(s) should be addressed? Who should carry out these studies?

f) Addition and discontinuation of program components:

To understand the patterns and trends in your subject area, are there program components which are unnecessary and could possibly be discontinued? Conversely, are program components missing which should be added or reinstated?

For example,

- (i) IEP EMP contaminant monitoring was discontinued in 1995. Consider the importance of information about contaminants for understanding SA patterns and trends in the Delta and evaluate the decision to discontinue contaminant monitoring.
- ii) EMP staff have been considering discontinuation of routine vertical (water column) dissolved oxygen (DO) measurements. Please evaluate this consideration.
- iii) Microbial monitoring could be added to assess flow effects on microbial densities and processes.

2. Site selection:

- a) What is the extent of spatial variability in the SA constituents? Does the EMP capture this spatial variability?
- b) Evaluate the current and historical sampling site selection and recommend changes as necessary. Is the current EMP coverage too detailed or sparse? Why?
- c) Currently most sites are channel sites. How important would it be to target other sites representative of other habitat types? Which habitats? Which sites?

3. Sampling frequency

- a) Evaluate the current and historical SA constituent sampling frequency and recommend changes as necessary. In particular, explore the sampling frequency with respect to the program's ability to adequately reflect or otherwise cope with tidal, fortnightly (spring/neap), seasonal and interannual variability as well as short- and long-term events.

- b) Many of the constituents measured by the EMP, such as temperature, salinity, turbidity, chlorophyll-a, etc. greatly vary at tidal and fortnightly periods. Are the data collected in the current EMP likely to be aliased at the tidal and fortnightly time scales? For example, if the measured parameters vary at fortnightly periods, data collected using bimonthly and monthly sampling is likely to be aliased.
- c) If sampling is conducted on a certain phase of the tide, what are the biases associated with sampling at only this phase of the tide? Is the EMP sampling on the 'most appropriate' phase of the tide? To sample at a consistent phase of the tide, discrete samples must be collected at the tide wave propagation speed, or at a rate of about ~20 knots in the channels. What are the consequences of not sampling at a consistent phase of the tide for your SA constituents?
- d) Evaluate the usefulness of discrete (boat and van) versus continuous (shore station) SA monitoring.

4. Concurrent Sampling

- a) Evaluate the advantages, disadvantages, and overall necessity of concurrent sampling. Concurrent sampling can be simultaneous sampling of the same constituents at several sites from more than one boat, van, or shore station, or of different constituents at one or more sites from a single vessel or van. *E.g.*, should zooplankton and benthic data be collected at the same time as water quality data?

5. Sample handling and storage

- a) Are samples handled and stored appropriately? If not, what needs to be changed?

B. Data use, analysis, synthesis, storage, and reporting

1. Assess the actual and potential uses of SA constituent monitoring data and information.
2. Evaluate the current state of analyzing, synthesizing, storing, and reporting SA results and recommend changes as necessary.

3. Does (or did) the monitoring program design allow for a comprehensive analysis of SA constituent status and trends due to flow regulations or other natural and anthropogenic pressures (especially those addressed by CALFED)?
4. Is data effectively turned into readily accessible, useful information? If not, how could this be accomplished? What type of information is most useful for the different data users (IEP/project managers and scientists)?
5. Does the monitoring of constituents included in your SA provide useful information to water project operators? If not, what should be changed?

C. Subject-area specific coordination/collaboration with other subject areas and other programs.

1. Evaluate the need or opportunities for coordination/collaboration of your SA monitoring program with other subject areas of the EMP.
2. Explore the spatial, temporal, and organizational scales at which such combined efforts would be most effective. Describe your findings.
3. To the extent possible, evaluate the need or opportunities for coordination/collaboration with other regional monitoring/research programs.

D. Implementation of recommendations

1. Provide a concrete plan for implementation of your recommendations including priorities, needed pilot/special studies, resource needs, time line, etc.

IV. Additional questions for specific subject areas

1. Water quality (boat and van sampling)

- a) There is evidence for lateral variability in water quality parameters, *e.g.* across Delta channels. Should this be addressed in the design of the EMP? Are spatial studies needed to quantify spatial variability (both vertical and lateral)?

2. Phytoplankton

- a) Like phytoplankton, microbial organisms (bacteria and protozoa) are at the base of the aquatic food web. They turn dissolved and particulate organic matter into biomass which may serve as an alternative food source for primary consumers and play a key role in biogeochemical cycling. Microbial organisms and related aspects have never been part of the IEP EMP. Some microbial measurements are routinely made by other programs to assess drinking water safety. Evaluate the importance and feasibility of microbial monitoring and its relationship to phytoplankton monitoring.
- b) Submerged aquatic vegetation (SAV) is also a producer of biomass, often essential in nutrient cycling, and an important structural element in aquatic habitats. Like microbial organisms, SAV has not been targeted by the IEP EMP. Evaluate the importance and feasibility of SAV monitoring and its relationship to phytoplankton monitoring.
- c) Attached (benthic and epiphytic) microalgae may also be an important producer group, especially if more shallow-water habitat is restored. Should this group of organisms be part of the EMP, and if so, how should it be included in the program design?

3. Zooplankton

- a) To date, microzooplankton other than smaller rotifers and copepod nauplii have not been part of the EMP. Should they be included (*i.e.* protozoa)? Why? And how?

4. Benthos

- a) It has been suggested that a field guide, containing an identification key as well as life history information for benthic organisms in the Delta, be created. This guide could be part of or linked to the meta-

data included with the EMP database. Please evaluate this idea. If you recommend such a field guide, please suggest an appropriate format and implementation strategy.

2.-4. PHYTOPLANKTON, ZOOPLANKTON, BENTHOS

- a) Is the SA sampling program prepared to detect, appropriately sample, and track newly introduced species or constituents gaining sudden importance? How flexible is the program, and how flexible can/should it be?
- b) The IEP EMP has historically measured organism abundance and abundance indices per area or water volume. Is this appropriate to the current questions, or are other measures necessary (e.g., biomass, production and consumption rates)? If recommended, how should these additional measurements be incorporated into the program design?

5. Continuous monitoring network

- a) There is evidence for lateral variability in water quality parameters, *e.g.* across Delta channels. How well do shore station data represent the cross section? Should certain stations be moved to bridge piers (center channel)? Are spatial studies needed to quantify spatial variability?
- b) Should data concurrently collected at the continuous monitoring stations be combined? For example, should the flow data be combined with water quality constituents such as EC and TOC to compute volumetric fluxes or loads?

List of background materials

Electronic files on the IEP Server at <http://iep.water.ca.gov/>

- Review background documents with appendices at <http://iep.water.ca.gov/emp/> **(please read)**
- Other IEP sites such as new and old data bases **(optional browsing)**

Sent by mail to subject area team and SAG members:

- Multi-year reports:

Lehman, P. W. 1996. Water quality conditions in the Sacramento-San Joaquin Delta, 1970-1993. Environmental Services Office, Department of Water Resources, 3251 S Street, Sacramento CA 95818.

Obrebski, S., J.J. Orsi, W. Kimmerer. 1992. Long Term Trends in Zooplankton Distribution and Abundance in the Sacramento-San Joaquin Estuary. IEP (Interagency Ecological Program for the Sacramento-San Joaquin Estuary) Technical Report 32. 42pp.

Hymanson, Z., D. Mayer, and J. Steinbeck. 1994. Long-term trends in benthos abundance and persistence in the upper Sacramento-San Joaquin Estuary. Summary report: 1980-1990. IEP (Interagency Ecological Program for the Sacramento-San Joaquin Estuary) Technical Report 38: 66 pp.

Markmann, C. 1986. Benthic monitoring in the Sacramento-San Joaquin Delta: results from 1975 through 1981. IESP (Interagency Ecological Studies Program for the Sacramento-San Joaquin Estuary) Technical Report 24: 51 pp., & app.

- Other reports:

IEP Estuarine Ecology Team, 1995. Working Conceptual Model for the Food Web of the San Francisco Bay/Delta Estuary. IEP (Interagency Ecological Program for the Sacramento-San Joaquin Estuary) Technical Report 42:29 pp.

Sample Table for subject area reviews (see. Subject Area Review Guidelines, p. 11)

Present information needs	Currently monitored constituents	Current method and data compatibility with other programs	Current customers	Current customer satisfaction (Are needs met? Efficiently?)	Recommendations for maintaining or improving customer satisfaction	Related future information needs and potential customers

Table originally generated by WQ SAT, 5/8/01. Revised by EMP core staff, 5/19/01.